Listing of Claims

This listing of claims will replace all prior versions, and listings, of claims in the Application.

Claim 1. (currently amended) Apparatus for changing the temperature of a wafer for chemical mechanical polishing operations, the apparatus comprising:

a wafer carrier having a surface for supporting a ~~an entire~~ back surface of the wafer;

a thermal energy transfer unit configured with a plurality of sections positioned at separate spaced locations defined by one given diameter of the wafer, each separate section being effective to transfer a separate amount of energy relative to one of the respective separate spaced locations; and

a thermal energy detector comprising a plurality of separate detectors spaced along the one given ~~a~~ diameter of the wafer, the separate detectors being configured so that one of the separate detectors corresponds to each separate spaced location of the thermal energy transfer unit for detecting the temperatures at each separate spaced location.

Claim 2. (currently amended) An apparatus as recited in claim 1, further comprising:

a controller responsive to each of the separate detectors for controlling a transfer of thermal energy relative to each respective separate spaced section of the thermal energy transfer unit, the controller being connected to respective ones of the separate detectors corresponding to each of the separate locations for controlling a transfer of thermal energy relative to each of the separate spaced locations of the thermal energy transfer unit to control a thermal gradient across the diameter of the wafer.

Claim 3. (currently amended) An apparatus as recited in claim 1, wherein the diameter along which the thermal energy detectors are spaced intersects each of the separate spaced sections, and wherein each detector that is spaced along the diameter is configured to output a signal representing the temperature of the corresponding separate spaced location; and the apparatus further comprises:

a system controller responsive to the signals from the detectors and programmed to provide an indication of an actual thermal gradient across the diameter that intersects each of the spaced sections, the system controller being programmed to compare the actual thermal gradient to a desired thermal gradient across the across the diameter that intersects each of the spaced sections; and

a thermal energy controller responsive to the system controller for controlling a supply of thermal energy to each separate spaced section of the thermal energy transfer unit to render the actual thermal gradient equal to the desired thermal gradient across the spaced sections along the diameter.

Claim 4. (currently amended) Apparatus for controlling local planarization properties on a wafer during the performance of a chemical mechanical polishing operation on the wafer, the apparatus comprising:

a wafer carrier;

a thermal energy transfer unit on the wafer carrier for transferring energy relative to the wafer, the thermal energy transfer unit having a plurality of separate thermal energy transfer sections, each of the separate sections being spaced along ~~a~~ and intersecting a common diameter of the wafer; and

a thermal energy detector system adjacent to the wafer for separately detecting a temperature of each location ~~locations~~ on the wafer at which the common diameter intersects the separate sections of the thermal energy transfer unit.

Claim 5. (currently amended) Apparatus as recited in claim 4, further comprising:

a controller responsive to the detector system separately detecting a temperature of each of the locations for controlling the transfer of thermal energy relative to the sections of the thermal energy transfer unit spaced along the common diameter to control a thermal gradient along the diameter.

Claim 6. (currently amended) Apparatus for controlling the temperature of a wafer for chemical mechanical polishing operations, the apparatus comprising:

a wafer carrier having a wafer mounting surface;

a thermal energy transfer unit adjacent to the wafer mounting surface for transferring energy relative to the wafer, the thermal energy transfer unit being configured with separate sections, each of the sections being configured to transfer the thermal energy to a different part of a wafer surface that is along a given diameter of the wafer, each of the sections being intersected by the given diameter, the sections collectively establishing ~~to establish~~ a thermal gradient across ~~a surface of~~ the diameter of the wafer;

a thermal energy detector unit adjacent to the wafer mounting surface, the thermal energy detector comprising separate detectors along the given diameter and adjacent to each of the intersections of the given diameter and the separate sections of

the thermal energy transfer unit for detecting the temperatures of the thermal gradient established by the separate sections ~~at locations across the surface of the wafer~~; and

a controller responsive to the separate detectors of the detector unit for controlling the transfer of thermal energy relative to the separate sections of the thermal energy transfer unit to control the temperatures of the thermal gradient.

Claim 7. (currently amended) An apparatus as recited in claim 6, wherein the thermal energy transfer unit is configured adjacent to a center of the wafer, and the thermal energy detector unit is configured to detect the temperatures of the thermal gradient along an arcuate path around the center of the wafer.

Claim 8. (currently amended) An apparatus as recited in claim 6, wherein:

the configuration of the thermal energy transfer unit is circular and the thermal energy transfer unit is located adjacent to an outer edge of the wafer; and

the thermal energy detector unit is defined by a plurality of detectors positioned in first and second circular arrays.

Claim 9. (original) An apparatus as recited in claim 8, wherein:

the first circular array corresponds to the circular configuration of the thermal energy transfer unit and the second circular array is adjacent to a center of the wafer.

Claim 10. (original) An apparatus as recited in claim 8, wherein:

the controller responds to the detector unit indicating a low temperature at an area of the surface of the wafer by connecting a source of thermal energy to the thermal energy transfer unit to raise the temperature of the area.

Claim 11. (original) An apparatus as recited in claim 8, wherein:

the controller responds to the detector unit indicating a high temperature at an area of the surface of the wafer by connecting a receiver of thermal energy to the thermal energy transfer unit to reduce the temperature of the area.

Claim 12. (currently amended) An apparatus as recited in claim 9, wherein:

the thermal energy transfer unit is configured to transfer the thermal energy relative to a plurality of parts of ~~areas across~~ the surface of the wafer to establish a uniform thermal condition across the surface, the plurality of areas intersecting the given ~~a~~ diameter of the wafer; and

the thermal energy detector unit is configured to detect the temperature of the plurality of parts of ~~areas across~~ the surface ~~and~~ across the diameter of the wafer.